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# LOAD BALANCING PROTOCOL LEACH IN WIRELESS SENSOR NETWORK

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**Abstract**

Abstrak – Jaringan sensor nirkabel adalah sejenis jaringan ad-hoc yang terdiri dari sensor terdistribusi untuk memantau kondisi fisik dan lingkungan yang bersifat otonom. Protocol LEACH adalah salah satu protocol yang dapat memperpanjang umur *wireless sensor network* dengan membentuk *cluster* untuk *routing* dalam jaringan skala besar. Modifikasi yang diusulkan dalam protocol LEACH memungkinkan node alternatif untuk menggantikan di tempat node yang kehilangan energinya sehingga memperpanjang masa hidup seleuruh jaringan dan menghindari kehilangan data. Wireless sensor network dengan multi sink memiliki beberapa kelemahan. Salah satu contoh adalah mengkonsumsi energi yang lebih cepat dari pada node yang lain. *Load balancing* adalah metode untuk menyamakan konsumsi energy semua node. Dengan *load balancing*, masa hidup suatu jaringan tidak hanya tergantung pada kehidupan node yang lemah tetapi tergantung pada kehidupan semua node dalam jaringan yang membantu meningkatkan kehidupan suatu jaringan. Dalam makalah ini, kami memeriksa algoritma *load balancing* yang diusulkan untuk jaringan wireless sensor. Oleh karena itu, makalah ini juga dapat memberikan kepada pembaca untuk penelitian dalam skema *load balancing* protocol LEACH wireless sensor network

**Keywords:** Wireless Sensor Network, Load Balancing, Network Lifetime

## I. INTRODUCTION

Wireless Sensor Network (WSN) is an ad hoc wireless network consisting of a number of small devices, known as sensors, and spread over certain geographical areas[1]. Each device has the ability to do data processing and communicate wirelessly, making it possible to collect information from the surrounding environment and generate and send messages to its remote base station. A remote base station, whose task is to collect and analyze the message received and decide the presence or absence of an unusual event or certain phenomenon in the area where the sensor is spread[2].

One of the main advantages of WSN is that it does not depend on cabling constraints and high budgets. To maintain all the benefits of WSN's wireless operation, each sensor node must be equipped with an inexpensive and continuously burning energy source. Therefore, each sensor node uses a small battery as its power source. While activities such as rechargingbatteries or replacing batteries in areas that are remote and out of reach, where the sensor nodes are located, is not an easy thing to do[3].

One of the main problems with power management is how to schedule sensors to obtain a longer network life time while still being able to meet the high quality of requested service[3]. Energy-efficient design to

extend WSN life time without sacrificing system reliability is an important challenge for the design of wider wireless sensor networks[3].

One of the strengths of WSN is its ability to work in an environment that is difficult for humans to enter due to risk, inefficient or sometimes impossible. Therefore, sensors are expected to replace monitoring through human, that is by random distribution in the observation area. This random distribution can be done by throwing it from a helicopter, which in the field later, these sensors can work together on an ad hoc basis[4]. With conditions like this, things that often happen are, the possibility of a faulty sensor and a sensor that has a short life time (due to low energy levels). Therefore, designing and operating this huge network requires a scalable management and architectural strategy. Because the limited energy levels and batteries of these nodes cannot be refilled, the design of efficient algorithms for energy use is very important to extend the viability of these sensors[5].

The widely used strategy is to merge nodes into a cluster. Each cluster has a leader (leader), called the cluster head (cluster head / CH). One of the cluster algorithms used in WSN is LEACH. LEACH on WSN is a protocol that regulates the concept of clustering for the nodes that are used[6].

The distribution of sensor nodes on WSN is still an interesting topic for researchers. A good sensor deployment must consider a good coverage area and connectivity. Coverage requires that every sensory field location be monitored by at least one sensor. Connectivity requires that the network is not fragmented in the communication node. Provisions to note are that coverage is influenced by the level of "sensitivity" of the sensor, while connectivity is affected by the communication of the sensor node[7].

Obstacles such as walls, buildings, house blocks or unexpected obstacles often occur in the sensing area. Obstacle significantly affects the coverage and connectivity of sensor nodes which means it will also affect the form of sensor deployment solutions[8]. The attenuation of the obstacle will have an impact on the range of communication between the sensors nodes because of the power lost during transmission. So that the energy consumed is not too large, it needs to be combined with load balancing which can provide the appropriate effectiveness[9].

## II. RESEARCH METHOD

In carrying out a study, a method is required which is the stages and activities that are part of the research roadmap. Researchers in conducting their research will use the model and simulation method that can be seen in Figure 1

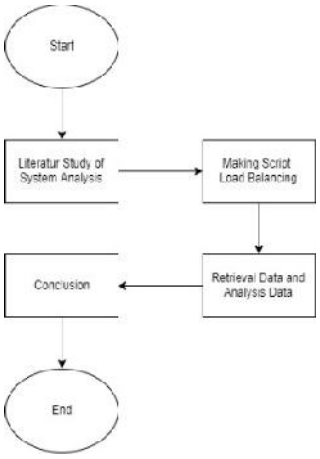


**Figure 1.** Research Method

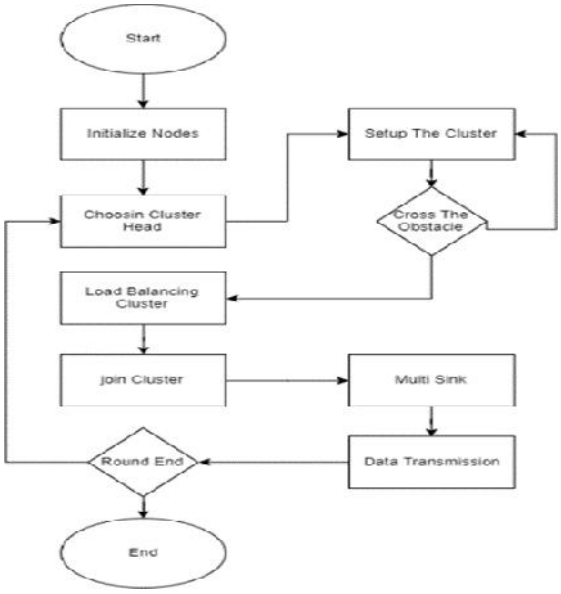


**Figure 2.** Flow modification of LEACH

Modification of the LEACH algorithm proposed in this study focuses on checking Load Balancing in cluster in multi sink. This algorithm runs with the nodes when the nodes will be associated with Cluster Head (CH).

**Algorithm 1**. Load Balancing

*Begin*

*Choose on of the CH Setup Cluster*

*Begin*

*Calculate intersection between signal and obstacle*

*If x between line of obstacle Signal cross the obstacle*

*Else*

*Signal not cross the obstacle End if*

*Load balancing cluster End*

*Join Cluster Nodes Join to Multi Sink CH End*

In this flow modification of LEACH, only adding load balancing in the cluster where the load balancing can provide energy usage that is not significant in its use. Below are the parameters used in the simulation in Table 1

**Table 1.** Parameters Simulation

| Parameters | Values |
|---|---|
| Simulation Area of Nodes | 100 x 100 m |
| Number of Nodes | 50 |
| Initial Energy | 0.5 J |
| Energy Aggregation Data | 5 nJ/bit |
| Eelec | 50 nJ/bit |
| EFS | 10 pJ/bit/$m^2$ |
| Emp | 0.0012 pJ/bit/$m^2$ |
| Cluster Head Prob. | 0,1 |
| Heterogeneity | 0,4 |
| Routing Algorithm | LEACH |
| Simulation Round Time | 100 |
| Data Tranmission | 1 bps |

## IV. RESULTS AND DISCUSSION

In this chapter we will discuss the simulation results that we research in modifying the LEACH algorithm. This simulation is first done by simulating an area of 100 x 100 m with a number of nodes of 50 nodes. In Figure 3, shows the flow of energy from each node that will be sent. From this channel will produce a Cluster Head (CH) in which the CH functions to regulate the load balancing energy used from each node and the blue line is the connecting path between one node to another node.

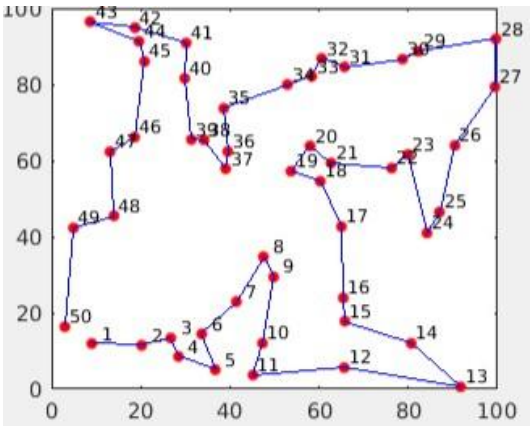


**Figure 3.** Node Energy Flow

In Figure 4. shows the results of energy distribution at each node so that the node will know which nodes communicate in consuming energy in each node.

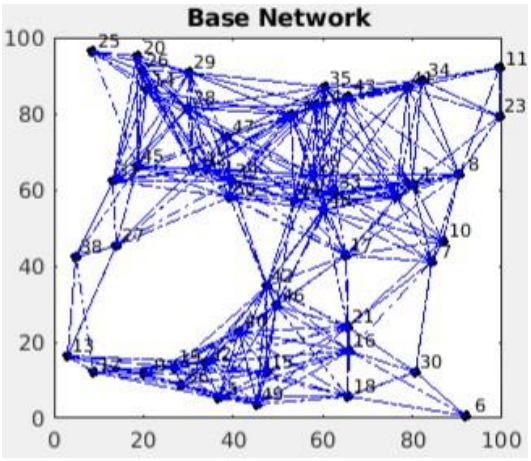


**Figure 4.** Spread of Energy on Nodes

From the simulation results for the modification of the LEACH protocol algorithm with the addition of load balancing, we get each rotation in one data transmission at the node consuming energy of 0,0004 J / s, so that it can be seen in the graph in Figure 5 below.

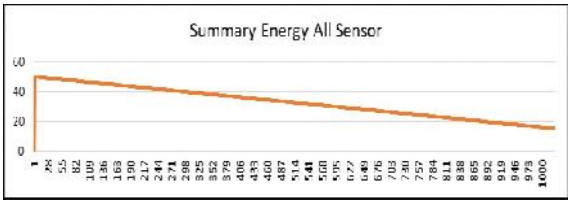


**Figure 6.** Energy Summary All Sensor Node

## V. Conclusion

In the amount of literature that we have in trying to make a simulation where this simulation can provide energy consumption from each node that sends data. In consuming energy each node only needs 0,0004 J / s of energy in one data transmission. In this research there are still many shortcomings in terms of the algorithm presented. Therefore, the future will be even better in making algorithms that are more efficient in maintaining the lifetime of each node.

## ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression, “One of us (R. B. G.) thanks . . .” Instead, try “R. B. G. thanks”. Put sponsor acknowledgments in the unnum-bered footnote on the first page.

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